

LEE - 10/725,381
Attorney Docket: 040008-0306859

REMARKS

Claims 1, 4, 5, 8, 9 and 12-17 are pending. By this Amendment, claim 1 is amended and claims 16 and 17 are added. Reconsideration in view of the above amendments and following remarks is respectfully requested.

Claims 1, 4, 5, 8, 9 and 12-15 were rejected under 35 U.S.C. § 103(a) over Applicant's Admitted Prior Art (APA) in view of Min et al. (Applied Physics Letters Vol. 75, Number 11, 1999) and Chen et al. (U.S. Patent 6,596,643). The rejection is respectfully traversed.

Claim 1 recites, *inter alia*, forming a TiSiN layer having a desired thickness by repeatedly performing a process of forming a TiSiN layer having an atomic layer thickness in a reaction chamber, wherein the process of forming a TiSiN layer having an atomic layer thickness comprises performing deposition of a Si layer inside the opening and on the insulating layer using an atomic layer deposition process, discharging a gas remaining in the reaction chamber by using an inert gas, performing deposition of a certain precursor layer on the Si layer, and discharging a gas of precursor material remaining in the reaction chamber by using an inert gas.

MPEP § 2143 states: "To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations."

The Examiner acknowledges that APA does not disclose forming a TiSiN layer. The Examiner relies on Min et al. to cure this deficiency of APA. It is respectfully submitted that Min et al. do not disclose or suggest, at least, discharging a gas remaining in the reaction chamber by using an inert gas and/or discharging a gas of precursor material remaining in the reaction chamber by using an inert gas.

Min et al. disclose sequentially supplying TDMAT, SiH₄, and NH₃ to the reactor and supplying an argon (Ar) pulse between each reactant gas pulse in order to isolate the reactant gases from each other. Min et al., however, do not disclose or suggest discharging gas remaining in the reactor or discharging a gas of precursor material remaining in the reaction chamber by using an inert gas.

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Chen et al. also fail to cure the deficiencies of APA and Min et al. with respect to claim 1. In addition, it is respectfully submitted that there is no motivation or suggestion, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine Chen et al. with APA and Min et al. in the manner alleged by the Examiner.

The Examiner alleges on page 3, lines 11-13 of the Office Action, that Chen et al. teach, in column 7, lines 13-41 and column 8, lines 41-43, a method of using TDMAT and SiH₄ to form a TiSiN layer comprising plasma processing (N₂/H₂ plasma) the layer to remove CH₃ impurities from the film. It is respectfully submitted that Chen et al. do not disclose or suggest plasma processing to remove impurities, as alleged by the Examiner.

Chen et al. disclose a method of forming a TiSiN barrier layer by CVD, not ALD, on a semiconductor wafer. The method includes plasma processing using N₂/H₂ plasma. The formation of the TiSiN barrier layer includes thermally decomposing TDMAT to deposit a film of TiN(C) on a wafer (column 8, lines 14-22), treating the TiN(C) film by using the N₂/H₂ plasma to reduce carbon concentration from the film (column 8, lines 41-43), and exposing the TiN film to a silicon-containing gas ambient such as a silane soak to yield a TiSiN film (column 8, lines 62-65). In other words, Chen et al. performs the plasma processing on the TiN(C) film to form a TiN film, not remove impurities, and then soaks the TiN in a silane to form the TiSiN layer. As the invention of claim 11 does not form the TiSiN layer by plasma processing a TiN(C) film, one of ordinary skill in the art would not have been motivated to combine Chen et al. with APA and Min et al.

Claims 4, 5, 8, 9 and 12-17 recite additional feature of the invention and are allowable for the same reasons discussed above with respect to claim 1 and for the additional features recited therein. In addition, with respect to claims 9 and 12, Applicant respectfully submits that there is no motivation to combine the ALD process of Min et al. with the CVD process of Chen et al. See the abstract of Min et al. which discloses that the Si content of the TiSiN film in the ALD process is strikingly different from the conventional CVD process.

Reconsideration and withdrawal of the rejection over APA in view of Min et al. and Chen et al. are respectfully requested.

In view of the above amendments and remarks, Applicant respectfully submits that all of the claims are allowable and the entire application is in condition for allowance.

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LEE -- 10/725,381
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Should the Examiner believe that anything further is desirable to place the application in better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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